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CLMPTO

June 04, 2005

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Claim 1 (original) A process for preparing a carbon black product having an organic group attached to the carbon black comprising the step of:

reacting at least one diazonium salt with a carbon black in the absence of an externally applied electric current sufficient to reduce the diazonium salt.

Claims 2-153 (canceled)

154. A carbon black product having an organic group attached to the carbon black, obtainable by a process comprising the step of reacting at least one diazonium salt with a carbon black in a protic reaction medium, wherein said diazonium salt is generated *in situ* from a primary amine, the protic medium is an aqueous medium, and the primary amine is an amine of the formula  $A_rArNH_2$ , in which:

$Ar$  is an aromatic or heteroaromatic radical;

$y$  is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

$A$ , which can be the same or different when  $y$  is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of a branched or unbranched  $C_1-C_{20}$  substituted alkyl, branched or unbranched  $C_3-C_{20}$  unsubstituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;
- a functional group selected from the group consisting of  $OR$ ,  $COR$ ,  $COOR$ ,  $OCOR$ , a carboxylate salt,  $CN$ ,  $NR_2$ ,  $SO_3H$ , a sulfonate salt,  $OSO_3H$ ,  $OSO_3^-$  salts,  $NR(COR)$ ,  $CONR_2$ ,  $NO_2$ ,  $OPO_3H_2$ , a monobasic or dibasic phosphate salt,  $PO_3H_2$ , a monobasic or dibasic phosphonate salt,  $N-NR$ ,  $N_2^+X^-$ ,  $NR_2^+X^-$ ,  $PR_3^+X^-$ ,  $S_2R$ ,  $SO_2NRR'$ ,  $SO_2SR$ ,  $SNRR'$ ,  $SSO_3H$ , a  $SSO_3^-$  salt,  $SNQ$ ,  $SO_2NQ$ ,  $CO_2NQ$ ,  $S-(1,4\text{-piperazinediyl})-SR$ ,  $2-(1,3\text{-dithianyl})$ ,  $2-(1,3\text{-dithiolanyl})$ ,  $SOR$ , and  $SO_2R$ ; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups and/or halogen(s);

wherein  $R$  and  $R'$ , which can be the same or different, are hydrogen; branched or unbranched  $C_1-C_{20}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl;  $k$  is an integer from 1 to 8;  $X^-$  is a halide or an anion derived from a mineral or organic acid; and  $Q$  is  $(CH_2)_w$ ,  $(CH_2)_zO(CH_2)_w$ ,  $(CH_2)_zNR(CH_2)_w$  or  $(CH_2)_zS(CH_2)_w$ , wherein  $x$  is 1 to 6,  $z$  is 1 to 6, and  $w$  is 2 to 6;

and wherein  $Ar$  is optionally further substituted with alkyl(s) and/or halogen(s).

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155. The carbon black product of claim 154, wherein

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of -CH radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of a branched or unbranched C<sub>1</sub>-C<sub>20</sub> substituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;
- a functional group selected from the group consisting of OR, COR, COOR, OCOR, a carboxylate salt, CN, NR<sub>2</sub>, SO<sub>3</sub>H, a sulfonate salt, OSO<sub>3</sub>H, OSO<sub>3</sub><sup>-</sup> salts, NR(COR), CONR<sub>2</sub>, NO<sub>2</sub>, OPO<sub>3</sub>H<sub>2</sub>, a monobasic or dibasic phosphate salt, PO<sub>3</sub>H<sub>2</sub>, a monobasic or dibasic phosphonate salt, N=NR, N<sub>2</sub>'X', NR<sub>3</sub>'X', PR<sub>3</sub>'X', S<sub>1</sub>R, SO<sub>2</sub>NRR', SO<sub>2</sub>SR, SNRR', SSO<sub>3</sub>H, a SSO<sub>3</sub><sup>-</sup> salt, SNQ, SO<sub>2</sub>NQ, CO<sub>2</sub>NQ, S-(1,4-piperazinediyl)-SR, 2-(1,3-dithianyl), 2-(1,3-dithiolanyl), SOR, and SO<sub>2</sub>R; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups and/or halogen(s);

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched C<sub>1</sub>-C<sub>20</sub> unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X' is a halide or an anion derived from a mineral or organic acid; and Q is (CH<sub>2</sub>)<sub>w</sub>, (CH<sub>2</sub>)<sub>x</sub>O(CH<sub>2</sub>)<sub>z</sub>, (CH<sub>2</sub>)<sub>x</sub>NR(CH<sub>2</sub>)<sub>z</sub>, or (CH<sub>2</sub>)<sub>x</sub>S(CH<sub>2</sub>)<sub>z</sub>, wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6;

and wherein Ar is optionally further substituted with alkyl(s) and/or halogen(s).

156. The carbon product of claim 154, wherein

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of -CH radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of OR, COR, COOR, OCOR, a carboxylate salt, CN, NR<sub>2</sub>, SO<sub>3</sub>H, a sulfonate salt, OSO<sub>3</sub>H, OSO<sub>3</sub><sup>-</sup> salts, NR(COR), CONR<sub>2</sub>, NO<sub>2</sub>, OPO<sub>3</sub>H<sub>2</sub>, a monobasic or dibasic phosphate salt, PO<sub>3</sub>H<sub>2</sub>, a monobasic or dibasic phosphonate salt, N=NR, N<sub>2</sub>'X', NR<sub>3</sub>'X', PR<sub>3</sub>'X', S<sub>1</sub>R, SO<sub>2</sub>NRR', SO<sub>2</sub>SR, SNRR', SSO<sub>3</sub>H, a SSO<sub>3</sub><sup>-</sup> salt, SNQ, SO<sub>2</sub>NQ, CO<sub>2</sub>NQ, S-(1,4-piperazinediyl)-SR, 2-(1,3-dithianyl), 2-(1,3-dithiolanyl), SOR, and SO<sub>2</sub>R; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups and/or halogen(s);

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched C<sub>1</sub>-C<sub>20</sub> unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X' is a halide or an anion derived from a mineral or organic acid; and Q is (CH<sub>2</sub>)<sub>w</sub>, (CH<sub>2</sub>)<sub>x</sub>O(CH<sub>2</sub>)<sub>z</sub>, (CH<sub>2</sub>)<sub>x</sub>NR(CH<sub>2</sub>)<sub>z</sub>, or (CH<sub>2</sub>)<sub>x</sub>S(CH<sub>2</sub>)<sub>z</sub>, wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6;

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and wherein Ar is optionally further substituted with alkyl(s) and/or halogen(s).

157. The carbon black product of claim 154, wherein

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of -CH radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is a functional group selected from the group consisting of a branched or unbranched C<sub>1</sub>-C<sub>20</sub> substituted alkyl, branched or unbranched C<sub>3</sub>-C<sub>20</sub> unsubstituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;

158. A carbon black product, having an aromatic group attached to the carbon black, obtainable by a process comprising the step of reacting at least one diazonium salt with a carbon black in a protic reaction medium, wherein said aromatic group is a group of the formula A<sub>y</sub>Ar, in which:

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of -CH radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of a branched or unbranched C<sub>1</sub>-C<sub>20</sub> substituted alkyl, branched or unbranched C<sub>3</sub>-C<sub>20</sub> unsubstituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;
- a functional group selected from the group consisting of OR, COR, COOR, OCOR, a carboxylate salt, CN, NR<sub>2</sub>, SO<sub>3</sub>H, a sulfonate salt, OSO<sub>3</sub>H, OSO<sub>3</sub><sup>-</sup> salts, NR(COR), CONR<sub>2</sub>, NO<sub>2</sub>, OPO<sub>3</sub>H<sub>2</sub>, a monobasic or dibasic phosphate salt, PO<sub>3</sub>H<sub>2</sub>, a monobasic or dibasic phosphonate salt, N=NR, N<sub>2</sub><sup>+</sup>X<sup>-</sup>, NR<sub>3</sub><sup>+</sup>X<sup>-</sup>, PR<sub>3</sub><sup>+</sup>X<sup>-</sup>, S<sub>4</sub>R, SO<sub>2</sub>NKR', SO<sub>2</sub>SR, SNRR', SSO<sub>3</sub>H, a SSO<sub>3</sub><sup>-</sup> salt, SNQ, SO<sub>2</sub>NQ, CO<sub>2</sub>NQ, S-(1,4-piperazinediyl)-SR, 2-(1,3-dithianyl), 2-(1,3-dithiolanyl), SOR, and SO<sub>2</sub>R; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups and/or halogen(s);

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched C<sub>1</sub>-C<sub>20</sub> unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X<sup>-</sup> is a halide or an anion derived from a mineral or organic acid;

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and Q is  $(CH_2)_x$ ,  $(CH_2)_xO(CH_2)_z$ ,  $(CH_2)_xNR(CH_2)_z$  or  $(CH_2)_xS(CH_2)_z$ , wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6;

and wherein Ar is optionally further substituted with alkyl(s) and/or halogen(s).

159. The carbon black product of claim 158, wherein

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of a branched or unbranched  $C_1-C_{10}$  substituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;
- a functional group selected from the group consisting of OR, COR, COOR, OCOR, a carboxylate salt, CN,  $NR_2$ ,  $SO_3H$ , a sulfonate salt,  $OSO_3H$ ,  $OSO_3^-$  salts,  $NR(COR)$ ,  $CONR_2$ ,  $NO_2$ ,  $OPO_3H_2$ , a monobasic or dibasic phosphate salt,  $PO_3H_2$ , a monobasic or dibasic phosphonate salt,  $N=NR$ ,  $N_2^+X^-$ ,  $NR_3^+X^-$ ,  $PR_3^+X^-$ ,  $S_4R$ ,  $SO_2NR_2$ ,  $SO_2SR$ ,  $SNRR'$ ,  $SSO_3H$ , a  $SSO_3^-$  salt,  $SNQ$ ,  $SO_2NQ$ ,  $CO_2NQ$ , S-(1,4-piperazinediyl)-SR, 2-(1,3-dithianyl), 2-(1,3-dithiolanyl), SOR, and  $SO_2R$ ; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups and/or halogen(s);

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched  $C_1-C_{10}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X' is a halide or an anion derived from a mineral or organic acid; and Q is  $(CH_2)_x$ ,  $(CH_2)_xO(CH_2)_z$ ,  $(CH_2)_xNR(CH_2)_z$  or  $(CH_2)_xS(CH_2)_z$ , wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6;

and wherein Ar is optionally further substituted with alkyl(s) and/or halogen(s).

160. The carbon black product of claim 158, wherein

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of OR, COR, COOR, OCOR, a carboxylate salt, CN,  $NR_2$ ,  $SO_3H$ , a sulfonate salt,  $OSO_3H$ ,  $OSO_3^-$  salts,  $NR(COR)$ ,  $CONR_2$ ,  $NO_2$ ,  $OPO_3H_2$ , a monobasic or dibasic phosphate salt,  $PO_3H_2$ , a

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monobasic or dibasic phosphonate salt,  $N=NR$ ,  $N_2^+X^-$ ,  $NR_3^+X^-$ ,  $PR_3^+X^-$ ,  $S_4R$ ,  $SO_2NRR'$ ,  $SO_2SR$ ,  $SNRR'$ ,  $SSO_3H$ , a  $SSO_3^-$  salt,  $SNQ$ ,  $SO_2NQ$ ,  $CO_2NQ$ ,  $S-(1,4\text{-piperazinediyl})-SR$ ,  $2-(1,3\text{-dithianyl})$ ,  $2-(1,3\text{-dithiolanyl})$ ,  $SOR$ , and  $SO_2R$ ; and

- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups and/or halogen(s);

wherein  $R$  and  $R'$ , which can be the same or different, are hydrogen; branched or unbranched  $C_1\text{-}C_{20}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl;  $k$  is an integer from 1 to 8;  $X^-$  is a halide or an anion derived from a mineral or organic acid; and  $Q$  is  $(CH_2)_w$ ,  $(CH_2)_xO(CH_2)_z$ ,  $(CH_2)_xNR(CH_2)_z$ , or  $(CH_2)_xS(CH_2)_z$ , wherein  $x$  is 1 to 6,  $z$  is 1 to 6, and  $w$  is 2 to 6;

and wherein  $Ar$  is optionally further substituted with alkyl(s) and/or halogen(s).

161. The carbon black product of claim 158, wherein

$Ar$  is an aromatic or heteroaromatic radical;

$y$  is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

$A$ , which can be the same or different when  $y$  is greater than 1, is a functional group selected from the group consisting of a branched or unbranched  $C_1\text{-}C_{20}$  substituted alkyl, branched or unbranched  $C_3\text{-}C_{20}$  unsubstituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;

162. The carbon black product of claim 158, wherein

$Ar$  is an aromatic or heteroaromatic radical;

$y$  is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

$A$ , which can be the same or different when  $y$  is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of a branched or unbranched  $C_1\text{-}C_{20}$  substituted alkyl, branched or unbranched  $C_3\text{-}C_{20}$  unsubstituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;
- a functional group selected from the group consisting of  $OR$ ,  $COR$ ,  $COOR$ ,  $OCOR$ , a carboxylate salt,  $CN$ ,  $NR_2$ ,  $SO_3H$ , a sulfonate salt,  $OSO_3H$ ,  $OSO_3^-$  salts,  $NR(COR)$ ,  $CONR_2$ ,  $NO_2$ ,  $OPO_3H_2$ , a monobasic or dibasic phosphate salt,  $PO_3H_2$ , a

monobasic or dibasic phosphonate salt,  $N=NR$ ,  $N_2^+X^-$ ,  $NR_3^+X^-$ ,  $PR_3^+X^-$ ,  $S_4R$ ,  $SO_2NRR'$ ,  $SO_2SR$ ,  $SNRR'$ ,  $SSO_3H$ , a  $SSO_3^-$  salt,  $SNQ$ ,  $SO_2NQ$ ,  $CO_2NQ$ ,  $3-(1,4\text{-}$

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piperazinediyl)-SR, 2-(1,3-dithianyl), 2-(1,3-dithiolanyl), SOR, and  $\text{SO}_2\text{R}$ ; and

- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups;

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched  $\text{C}_1\text{-C}_{20}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X' is a halide or an anion derived from a mineral or organic acid; and Q is  $(\text{CH}_2)_w$ ,  $(\text{CH}_2)_x\text{O}(\text{CH}_2)_z$ ,  $(\text{CH}_2)_x\text{NR}(\text{CH}_2)_z$ , or  $(\text{CH}_2)_x\text{S}(\text{CH}_2)_z$ , wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6.

163. The carbon black product of claim 158, wherein said aromatic group is a group of the formula  $\text{A}_y\text{Ar}$ , in which:

Ar is an aromatic radical selected from the group consisting of phenyl, naphthyl, anthryl, phenanthryl, biphenyl, and pyridyl;

y is an integer from 1 to 5 when Ar is phenyl, 1 to 7 when Ar is naphthyl, 1 to 9 when Ar is anthryl, phenanthryl, or biphenyl, and 1 to 4 when Ar is pyridyl; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of a branched or unbranched  $\text{C}_1\text{-C}_{20}$  substituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;
- a functional group selected from the group consisting of OR, COR, COOR, OCOR,  $\text{COOLi}$ ,  $\text{COONa}$ ,  $\text{COOK}$ ,  $\text{COONR}_4^+$ , CN,  $\text{NR}_2$ ,  $\text{SO}_3\text{H}$ ,  $\text{SO}_3\text{Li}$ ,  $\text{SO}_3\text{Na}$ ,  $\text{SO}_3\text{K}$ ,  $\text{SO}_3^-\text{NR}_4^+$ ,  $\text{NR}(\text{COR})$ ,  $\text{CONR}_2$ ,  $\text{NO}_2$ ,  $\text{PO}_3\text{HNa}$ ,  $\text{PO}_3\text{Na}_2$ ,  $\text{N=NR}$ ,  $\text{N}_2^+\text{X}^-$ ,  $\text{X}^-$ ,  $\text{PR}_3^+\text{X}^-$ ,  $\text{SiR}_3$ , SOR, and  $\text{SO}_2\text{R}$ ; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups;

wherein R is hydrogen; branched or unbranched  $\text{C}_1\text{-C}_{20}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; and X' is a halide or an anion derived from a mineral or organic acid.

164. The carbon black product of claim 158, wherein said aromatic group is a group of the formula  $\text{A}_y\text{Ar}$ , in which:

Ar is an aromatic radical selected from the group consisting of phenyl, naphthyl, benzothiazolyl, and benzothiadiazolyl;

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y is an integer from 1 to 5 when Ar is phenyl, 1 to 7 when Ar is naphthyl, 1 to 4 when Ar is benzothiazolyl, and 1 to 3 when Ar is benzothiadiazolyl; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of  $S_6R$ ,  $SSO_3H$ ,  $SO_2NRR'$ ,  $SO_2SR$ ,  $SNRR'$ ,  $SNQ$ ,  $SO_2NQ$ ,  $CO_2NQ$ ,  $S-(1,4\text{-piperazinediyl})\text{-SR}$ ,  $2-(1,3\text{-dithienyl})$ ,  $2-(1,3\text{-dithiolanyl})$ ; and

- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups;

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched  $C_1\text{-}C_{20}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X' is a halide or an anion derived from a mineral or organic acid; and Q is  $(CH_2)_w$ ,  $(CH_2)_xO(CH_2)_z$ ,  $(CH_2)_xNR(CH_2)_z$  or  $(CH_2)_xS(CH_2)_z$ , wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6.

165. The carbon black product of claim 158, wherein

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of OR, COR, COOR, OCOR, a carboxylate salt, CN,  $NR_2$ ,  $SO_3H$ , a sulfonate salt,  $OSO_3H$ ,  $OSO_3^-$  salts,  $NR(COR)$ ,  $CONR_2$ ,  $NO_2$ ,  $OPO_3H_2$ , a monobasic or dibasic phosphate salt,  $PO_3H_2$ , a monobasic or dibasic phosphonate salt,  $N=NR$ ,  $N_2^+X^-$ ,  $NR_3^+X^-$ ,  $PR_3^+X^-$ ,  $S_6R$ ,  $SO_2NRR'$ ,  $SO_2SR$ ,  $SNRR'$ ,  $SSO_3H$ , a  $SSO_3^-$  salt,  $SNQ$ ,  $SO_2NQ$ ,  $CO_2NQ$ ,  $S-(1,4\text{-piperazinediyl})\text{-SR}$ ,  $2-(1,3\text{-dithienyl})$ ,  $2-(1,3\text{-dithiolanyl})$ , SOR, and  $SO_2R$ ; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups;

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched  $C_1\text{-}C_{20}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X' is a halide or an anion derived from a mineral or organic acid; and Q is  $(CH_2)_w$ ,  $(CH_2)_xO(CH_2)_z$ ,  $(CH_2)_xNR(CH_2)_z$  or  $(CH_2)_xS(CH_2)_z$ , wherein x is 1 to 6, z is 1 to 6,

and w is 2 to 6.

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166. The carbon black product of claim 165, wherein said aromatic group is a group of the formula  $A_yAr$ , in which:

Ar is an aromatic radical selected from the group consisting of phenyl, naphthyl, anthryl, phenanthryl, biphenyl, and pyridyl;

y is an integer from 1 to 5 when Ar is phenyl, 1 to 7 when Ar is naphthyl, 1 to 9 when Ar is anthryl, phenanthryl, or biphenyl, and 1 to 4 when Ar is pyridyl; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of OR, COR, COOR, OCOR, COOLi, COONa, COOK, COONR<sub>4</sub><sup>+</sup>, CN, NR<sub>2</sub>, SO<sub>3</sub>H, SO<sub>3</sub>Li, SO<sub>3</sub>Na, SO<sub>3</sub>K, SO<sub>3</sub><sup>-</sup>, NR<sub>4</sub><sup>+</sup>, NR(COR), CONR<sub>2</sub>, NO<sub>2</sub>, PO<sub>3</sub>HNa, PO<sub>3</sub>Na<sub>2</sub>, N=NR, N<sub>2</sub><sup>+</sup>X<sup>-</sup>, X<sup>-</sup>, PR<sub>3</sub><sup>+</sup>X<sup>-</sup>, S<sub>2</sub>R, SOR, and SO<sub>2</sub>R; and

- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups;

wherein R is hydrogen; branched or unbranched C<sub>1</sub>-C<sub>20</sub> unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; and X<sup>-</sup> is a halide or an anion derived from a mineral or organic acid.

167. The carbon black product of claim 165, wherein said aromatic group is a group of the formula  $A_yAr$ , in which:

Ar is an aromatic radical selected from the group consisting of phenyl, benzothiazolyl, and benzothiadiazolyl;

y is an integer from 1 to 5 when Ar is phenyl, 1 to 4 when Ar is benzothiazolyl, and 1 to 3 when Ar is benzothiadiazolyl; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of S<sub>2</sub>R, SSO<sub>3</sub>H, SO<sub>2</sub>NRR<sup>+</sup>, SO<sub>2</sub>SR, SNRR<sup>+</sup>, SNQ, SO<sub>2</sub>NQ, CO<sub>2</sub>NQ, S-(1,4-piperazinediyl)-SR, 2-(1,3-dithianyl), 2-(1,3-dithiolanyl); and

- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups;

wherein R and R<sup>+</sup>, which can be the same or different, are hydrogen; branched or unbranched C<sub>1</sub>-C<sub>20</sub> unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X<sup>-</sup> is a halide or an anion derived from a mineral or organic acid;



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and Q is  $(CH_2)_x$ ,  $(CH_2)_xO(CH_2)_z$ ,  $(CH_2)_xNR(CH_2)_z$  or  $(CH_2)_xS(CH_2)_z$ , wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6.

168. A carbon black product comprising a carbon black and at least one organic group attached to the carbon black, wherein the organic group is an aromatic group of the formula  $A_yAr$ , wherein:

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of a branched or unbranched  $C_1$ - $C_{10}$  substituted alkyl, branched or unbranched  $C_3$ - $C_{10}$  unsubstituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;
- a functional group selected from the group consisting of OR, COR, COOR, OCOR, a carboxylate salt, CN,  $NR_2$ ,  $SO_3H$ , a sulfonate salt,  $OSO_3H$ ,  $OSO_3^-$  salts,  $NR(COR)$ ,  $CONR_2$ ,  $NO_2$ ,  $OPO_3H_2$ , a monobasic or dibasic phosphate salt,  $PO_3H_2$ , a monobasic or dibasic phosphonate salt,  $N=NR$ ,  $N_2^+X^-$ ,  $NR_2^+X^-$ ,  $PR_3^+X^-$ ,  $S_2R$ ,  $SO_2NRR'$ ,  $SO_2SR$ ,  $SNRR'$ ,  $SSO_3H$ , a  $SSO_3^-$  salt,  $SNQ$ ,  $SO_2NQ$ ,  $CO_2NQ$ ,  $S-(1,4\text{-piperazinediyl})-SR$ , 2-(1,3-dithianyl), 2-(1,3-dithiolanyl),  $SOR$ , and  $SO_2R$ ; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups and/or halogen(s);

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched  $C_1$ - $C_{10}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X' is a halide or an anion derived from a mineral or organic acid; and Q is  $(CH_2)_x$ ,  $(CH_2)_xO(CH_2)_z$ ,  $(CH_2)_xNR(CH_2)_z$  or  $(CH_2)_xS(CH_2)_z$ , wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6;

and wherein Ar is optionally further substituted with alkyl(s) and/or halogen(s).

169. The carbon black product of claim 168, wherein:

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of a branched or unbranched

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$C_1$ - $C_{20}$  substituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;

- a functional group selected from the group consisting of OR, COR, COOR, OCOR, a carboxylate salt, CN,  $NR_2$ ,  $SO_3H$ , a sulfonate salt,  $OSO_3H$ ,  $OSO_3^-$  salts,  $NR(COR)$ ,  $CONR_2$ ,  $NO_2$ ,  $OPO_3H_2$ , a monobasic or dibasic phosphate salt,  $PO_3H_2$ , a monobasic or dibasic phosphonate salt,  $N=NR$ ,  $N_2^+X^-$ ,  $NR_3^+X^-$ ,  $PR_3^+X^-$ ,  $S_4R$ ,  $SO_2NRR'$ ,  $SO_2SR$ ,  $SNRR'$ ,  $SSO_3H$ , a  $SSO_3^-$  salt,  $SNQ$ ,  $SO_2NQ$ ,  $CO_2NQ$ ,  $S$ -(1,4-piperazinediyl)-SR, 2-(1,3-dithianyl), 2-(1,3-dithiolanyl), SOR, and  $SO_2R$ ; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups and/or halogen(s);

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched  $C_1$ - $C_{20}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8;  $X^-$  is a halide or an anion derived from a mineral or organic acid; and Q is  $(CH_2)_x$ ,  $(CH_2)_xO(CH_2)_z$ ,  $(CH_2)_xNR(CH_2)_w$  or  $(CH_2)_xS(CH_2)_w$ , wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6;

and wherein Ar is optionally further substituted with alkyl(s) and/or halogen(s).

170. The carbon black product of claim 168, wherein:

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of -CH radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of OR, COR, COOR, OCOR, a carboxylate salt, CN,  $NR_2$ ,  $SO_3H$ , a sulfonate salt,  $OSO_3H$ ,  $OSO_3^-$  salts,  $NR(COR)$ ,  $CONR_2$ ,  $NO_2$ ,  $OPO_3H_2$ , a monobasic or dibasic phosphate salt,  $PO_3H_2$ , a monobasic or dibasic phosphonate salt,  $N=NR$ ,  $N_2^+X^-$ ,  $NR_3^+X^-$ ,  $PR_3^+X^-$ ,  $S_4R$ ,  $SO_2NRR'$ ,  $SO_2SR$ ,  $SNRR'$ ,  $SSO_3H$ , a  $SSO_3^-$  salt,  $SNQ$ ,  $SO_2NQ$ ,  $CO_2NQ$ ,  $S$ -(1,4-piperazinediyl)-SR, 2-(1,3-dithianyl), 2-(1,3-dithiolanyl), SOR, and  $SO_2R$ ; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups and/or halogen(s);

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched  $C_1$ - $C_{20}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8;  $X^-$  is a halide or an anion derived from a mineral or organic acid;

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and Q is  $(CH_2)_w$ ,  $(CH_2)_wO(CH_2)_z$ ,  $(CH_2)_wNR(CH_2)_z$ , or  $(CH_2)_wS(CH_2)_z$ , wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6;

and wherein Ar is optionally further substituted with alkyl(s) and/or halogen(s).

171. The carbon black product of claim 168, wherein:

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is a functional group selected from the group consisting of a branched or unbranched  $C_1$ - $C_{20}$  substituted alkyl, branched or unbranched  $C_3$ - $C_{10}$  unsubstituted alkyl, unsubstituted or substituted alkenyl, unsubstituted or substituted alkynyl, unsubstituted or substituted heteroaryl, unsubstituted or substituted alkylaryl, and unsubstituted or substituted arylalkyl;

172. The carbon black product of claim 168, wherein:

Ar is an aromatic or heteroaromatic radical;

y is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of OR, COR, COOR, OCOR, a carboxylate salt, CN,  $NR_2$ ,  $SO_2H$ , a sulfonate salt,  $OSO_2H$ ,  $OSO_2^-$  salts,  $NR(COR)$ ,  $CONR_2$ ,  $NO_2$ ,  $OPO_3H_2$ , a monobasic or dibasic phosphate salt,  $PO_3H_2$ , a monobasic or dibasic phosphonate salt,  $N=NR$ ,  $N_2^+X^-$ ,  $NR_2^+X^-$ ,  $PR_3^+X^-$ ,  $S_2R$ ,  $SO_2NRR'$ ,  $SO_2SR$ ,  $SNRR'$ ,  $SSO_2H$ , a  $SSO_2^-$  salt,  $SNQ$ ,  $SO_2NQ$ ,  $CO_2NQ$ , 5-(1,4-piperazinediyl)-SR, 2-(1,3-dithianyl), 2-(1,3-dithiolanyl), SOR, and  $SO_2R$ ; and

- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups;

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched  $C_1$ - $C_{10}$  unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X<sup>-</sup> is a halide or an anion derived from a mineral or organic acid; and Q is  $(CH_2)_w$ ,  $(CH_2)_wO(CH_2)_z$ ,  $(CH_2)_wNR(CH_2)_z$ , or  $(CH_2)_wS(CH_2)_z$ , wherein x is 1 to 6, z is 1 to 6, and w is 2 to 6.

173. The carbon black product of claim 168, wherein:

Ar is an aromatic radical selected from the group consisting of phenyl, naphthyl, anthryl, phenanthryl, biphenyl, and pyridyl;

y is an integer from 1 to the total number of  $-CH$  radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent

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on the aromatic radical selected from:

- a functional group selected from the group consisting of OR, COR, COOR, OCOR, COOLi, COONa, COOK, COONR<sub>4</sub><sup>+</sup>, CN, NR<sub>2</sub>, SO<sub>3</sub>H, SO<sub>3</sub>Li, SO<sub>3</sub>Na, SO<sub>3</sub>K, SO<sub>3</sub><sup>-</sup>NR<sub>4</sub><sup>+</sup>, NR(COR), CONR<sub>2</sub>, NO<sub>2</sub>, PO<sub>3</sub>H<sub>2</sub>, PO<sub>3</sub>HNa, PO<sub>3</sub>Na<sub>2</sub>, N=NR, N<sub>2</sub><sup>+</sup>X<sup>-</sup>, NR<sub>2</sub><sup>+</sup>X<sup>-</sup>, PR<sub>3</sub><sup>+</sup>X<sup>-</sup>, S<sub>2</sub>R, SOR, and SO<sub>2</sub>R; and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups;

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched C<sub>1</sub>-C<sub>10</sub> unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; X<sup>-</sup> is a halide or an anion derived from a mineral or organic acid.

174. The carbon black product of claim 168, wherein:

Ar is an aromatic radical selected from the group consisting of phenyl, benzothiazolyl, and benzothiadiazolyl;

y is an integer from 1 to the total number of -CH radicals present in the aromatic radical; and

A, which can be the same or different when y is greater than 1, is independently a substituent on the aromatic radical selected from:

- a functional group selected from the group consisting of S<sub>2</sub>R, SSO<sub>2</sub>H, SO<sub>2</sub>NRR', SO<sub>2</sub>SR, SNRR', SNQ, SO<sub>2</sub>NQ, CO<sub>2</sub>NQ, 5-(1,4-piperazinediyl)-SR, 2-(1,3-dithianyl), 2-(1,3-dithiolanyl); and
- a linear, branched, aromatic, or cyclic hydrocarbon radical, substituted with one or more of said functional groups;

wherein R and R', which can be the same or different, are hydrogen; branched or unbranched C<sub>1</sub>-C<sub>20</sub> unsubstituted or substituted alkyl, alkenyl, or alkynyl; unsubstituted or substituted aryl; unsubstituted or substituted heteroaryl; unsubstituted or substituted alkylaryl; or unsubstituted or substituted arylalkyl; k is an integer from 1 to 8; and Q is (CH<sub>2</sub>)<sub>w</sub>, (CH<sub>2</sub>)<sub>z</sub>O(CH<sub>2</sub>)<sub>x</sub>, (CH<sub>2</sub>)<sub>z</sub>NR(CH<sub>2</sub>)<sub>x</sub>, or (CH<sub>2</sub>)<sub>z</sub>S(CH<sub>2</sub>)<sub>x</sub>, wherein X is 1 to 6, z is 1 to 6, and w is 2 to 6.

175. A carbon black product comprising a carbon black and at least one organic group having a) an aromatic group and b) a cationic group, wherein at least one aromatic group of the organic group is attached to the carbon black and wherein the organic group is a N-substituted pyridinium group.

176. A carbon black product comprising a carbon black and at least one organic group ArOH attached to the carbon black, wherein Ar is arylene or heteroarylene.

177. A carbon black product comprising a carbon black and at least one organic group Ar(CH<sub>2</sub>)<sub>k</sub>S<sub>2</sub>(CH<sub>2</sub>)<sub>k</sub>Ar' attached to the carbon black, wherein Ar and Ar' are arylene, k is an integer

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from 1 to 8, and q and r are 0.

178. A carbon black product comprising a carbon black and at least one organic group  $\text{Ar}(\text{CH}_2)_k\text{S}_q(\text{CH}_2)_r\text{Ar}'$  attached to the carbon black, wherein Ar and Ar' are heteroarylene, k is an integer from 1 to 8, and q and r are 0.

179. A process for preparing a carbon black product having an organic group attached to the carbon black comprising the step of:

reacting at least one diazonium salt with a carbon black in a protic reaction medium, wherein the diazonium salt is generated in situ from the primary amine  $\text{H}_2\text{NArS}_k\text{Ar}'\text{NH}_2$  wherein Ar is benzothiazolyene and k is 2.

180. A plastic composition comprising a plastic and the carbon product according to claim 154.

181. A paper product comprising paper pulp and the carbon product according to claim 154.

182. A fiber or textile composition comprising a fiber or textile and the carbon black product according to claim 154.

183. An elastomer composition obtainable by mixing at least one elastomer and the carbon black product according to claim 154.

184. The elastomer composition of claim 183, wherein the elastomer comprises at least one synthetic or natural polymer of 1,3-butadiene, styrene, isoprene, isobutylene, 2,3-dimethyl-1,3-butadiene, acrylonitrile, ethylene, or propylene.

185. The elastomer composition of claim 184, further comprising at least one additive selected from the group consisting of: a curing agent, a coupling agent, a processing aid, an oil extender, and an antioxidant.

186. A cured elastomer composition obtainable by curing the elastomer composition of claim 183.

187. A rubber composition obtainable by mixing a rubber and the carbon black product according to claim 154.

188. The rubber composition of claim 187, wherein the rubber comprises a natural rubber, a synthetic rubber, or mixtures of a natural and synthetic rubber.

189. The rubber composition of claim 188, wherein the rubber is selected from the group consisting of: copolymers of from about 10 to about 70 percent by weight of styrene and from about 90 to about 30 percent by weight of butadiene, polymers of conjugated dienes, and copolymers of conjugated dienes with ethylenic group-containing monomers.

190. The rubber composition of claim 189, wherein the rubber is a rubber selected from the group consisting of: polybutadiene, polyisoprene, polychloroprene, and poly(styrene-butadiene).

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191. The rubber composition of claim 190, further comprising at least one additive selected from the group consisting of: a curing agent, a coupling agent, a processing aid, an oil extender, and an antioxidant.

192. A cured rubber composition obtainable by curing the rubber composition of claim 187.

193. A tire or tire component comprising the elastomer composition of claims 183.

194. A tire or tire component comprising the rubber composition of claims 187.

195. A method of decreasing the tan delta max at 70 deg C of an elastomer composition comprising the step of combining an elastomer with at least one carbon black product of claims 154.

196. The method of claim 195, further comprising forming the elastomer composition into a tire or tire component.

197. A method of increasing the abrasion resistance of an elastomer composition comprising the step of combining an elastomer with at least one carbon black product of claim 154.

198. The method of claim 197, further comprising forming the elastomer composition into a tire or tire component.